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by

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Foreign Ownership, Technological Capabilities and Exports: Evidence from 205 Clothing Firms in Sri Lanka

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ABSTRACT

Sri Lanka was the earliest South Asian economy to introduce economic reforms to attract export-oriented FDI. The rise of clothing production for export, apparently mainly driven by foreign firms, is regarded as a major outcome of the reforms. This paper seeks to examine a range of factors underlying firm-level export and technological performance. Econometric analysis (based on a large dataset of 205 clothing enterprises) indicates that foreign ownership, firm size, human capital, technological capabilities and geographical location are all positively associated with export shares. Furthermore, higher levels of technological capability are associated with larger firm size, university-level manpower and formal research and development. Improving the country's investment climate, facilitating the development of business services markets and upgrading SMEs as subcontractors to foreign firms are important policy lessons for developing economies

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1) INTRODUCTION

The creation of an internationally competitive clothing industry in Sri Lanka is one of major achievements of the economic reforms introduced in 1977. The 1977 reforms adopted a liberal attitude towards foreign direct investment (FDI) making Sri Lanka South Asia's earliest liberalizer and its most hospitable destination for foreign investment. Key policy measures included liberalization of foreign investment laws, tax holidays on profits and salaries, duty-free access to imported inputs and setting up the Katunayake Investment Processing Zone (Ganeshamoorthy, 2002). The bulk of FDI was destined for the clothing industry in Sri Lanka which received a twenty-two fold increase in annual FDI inflows from $12 million in 1987-89 to $264 million in 2000-2004 (see Table A1).[2] Foreign firms presently generate clothing exports worth $2 billion per year (2000-2002) and a total of 280,234 jobs. Transformed by FDI, the clothing industry has thus emerged as the country's largest manufactured export (accounting for 66% of total manufactured exports in 2000-2004) and manufacturing employer. Domestic firms gradually entered export markets initially as subcontractors and then direct exporters.

Empirical studies on FDI in clothing industry in Sri Lanka have been carried out largely at the macro and industry level. This literature has examined trends in FDI, factors affecting FDI inflows, the efficiency of the investment incentives and the paucity of backward linkages within the clothing industry (for a selection see Lakshman, 1989; FIAS 1993; Kelegama and Foley, 1999; Athukorala, and Rajapathirana, 2000; UNCTAD, 2004). The following have been suggested to explain the entry of export-oriented FDI into clothing in Sri Lanka: a strategic geographical location, access to multi-fibre agreement (MFA) quotas, attractive investment incentives, and ample supplies of low cost and trainable labour. Sri Lanka's persistent locational disadvantages are said to include: political instability, poor quality physical infrastructure, and weak sub-contractors/industrial suppliers to MNCs.

Few attempts have been made, however, to examine the export behaviour of foreign and local firms in the clothing industry in Sri Lanka. Investigation of this issue has been hampered by the lack of firm-level data and the need for costly firm surveys. The handful of case studies of clothing firms and small sample econometric analysis highlight two notable findings: (a) foreign firms are better exporters than domestic firms; and (b) that technological capabilities and human capital approaching international best practice levels are important determinants of export advantage (Lall and Wignaraja, 1995; Wignaraja, 1998; Deraniyagala, 2001; Chandrasiri, 2003; Knutsen, 2004). These preliminary yet striking findings require empirical verification and further analysis using larger samples of clothing firms. Clarification of this issue would also contribute to policy debates in Sri Lanka (and elsewhere in the developing world) over the role of ownership in clothing industry in a post-MFA context and the allocation of incentives towards foreign or domestic firms.

[2] The striking feature of the industry in Sri Lanka, as Lall *et al.* (1996) note, is the dualism between the newer export-oriented clothing and the older domestic-oriented textile sub-sectors. The more efficient clothing sub-sector accounts for most of the FDI and exports. Accordingly, the clothing industry in this paper is broadly defined to include the clothing sub-sector and the textiles sub-sector (spinning, weaving, knitting and finishing).

Building on the small sample econometric study of Wignaraja (1998), this paper examines a variety of characteristics besides foreign ownership which are able to influence a firm's export behaviour (including technological capabilities, human capital, size and geographical location). As a proxy for technological capabilities, the paper considers a simplified technology index (TI) based on five technical functions. The paper goes on to analyse the determinants of the TI (e.g. firm size, age, share of professional workers, training and R&D). T-tests to further explore ownership differences in exporting and a mapping of enterprise perceptions of the investment climate provide additional insights. The sample used here is a large one (205 clothing firms) and was surveyed in 2004. Section 2 surveys recent literature on firm-level export performance and technological capabilities in developing countries. Section 3 presents the data, T-test and econometric results. Section 4 analyses the investment climate. Section 5 concludes.

2) STUDIES ON FIRM-LEVEL EXPORTS AND TECHNOLOGICAL CAPABILITIES

The major theories of international trade - the Heckscher-Ohlin Model, theories of economies of scale and oligopolistic competition and the neotechnology theories of Posner and Vernon - have become the dominant explanation of the source of comparative advantage (see Wakelin, 1997 for a recent survey). Each of these theories attributes the export performance of a small open developing economy (e.g. Sri Lanka) to the comparative advantage this economy would have over another in terms of access to certain factor inputs – such as capital, labour, economies of scale and technology. Empirical applications of these theories to developing countries have sought to explain the export performance of each industry/product in terms of their various characteristics.

A relatively recent development in the applied international trade literature, which has roots in the neo-Heckscher-Ohlin Model and the neotechnology theories, is the analysis of export performance of firms in developing countries. This literature suggests that the theoretical determinants of comparative advantage, which are traditionally recognised as industry-level factors, can also operate at firm-level (Lall, 1986, Kumar and Siddharthan, 1994 and Bhaduri and Ray, 2004). Conditions of imperfect markets with widespread oligopoly as well as differences in technologies, learning and tastes underlie the notion of firm-specific advantages. It follows that almost all the theories of comparative advantage can be firm-specific determining not only which countries will enjoy a comparative advantage in international markets but also which firms can exploit that comparative advantage better than others. Incorporating the notion of firm-specific advantages, somewhat modifies the predictions of the theories of international trade as follows:

a) there are country-specific and industry-specific advantages which apply to all firms equally; and

b) within this, some advantages will be firm-specific since certain managerial, organizational, marketing and other skills will be peculiar to each firm as will production methods, technologies and experience based know-how.

A related strand of literature, drawing on innovation and learning processes in developing countries, emphasises the acquisition of technological capabilities as a major source of export advantage at firm-level (see Lall, 1992; Bell and Pavitt, 1993; Pietrobelli, 1997; Ernst *et al.*, 1998). This literature underlies the difficult firm-specific processes involved in building technological capabilities to use imported technology efficiently. The central argument is that firms have to undertake conscious investments in search, training, engineering and, even research and development, to put imported technologies to productive use. Furthermore, capability building rarely occurs in isolation and involves active cooperation between firms and support institutions for technology and export marketing. Hence, differences in the efficiency with which firm-level capabilities are created are themselves a major source of competitive advantage.

It is challenging, however, to measure inter-firm differences in technological capabilities in developing countries. In the last decade or so, studies have begun to develop a simple summary measure of technological capabilities by ranking the technical functions performed by enterprises (see the pioneering work on Thailand is by Westphal *et al.* 1990).[3] The ranking procedure integrates objective and subjective information into measures of a firm's capacity to set up, operate and transfer technology. The typical approach is to highlight the various technical functions performed by enterprises and to award a score for each activity based on the assessed level of competence in that activity. An overall capability score for a firm is obtained by taking an average of the scores for the different technical functions. As discussed below, the overall capability score (often referred to as a technology index or TI) has proved robust in statistical analysis of export and technological performance.

The available empirical studies have generally confirmed the importance of the theoretical determinants of comparative advantage at firm-level (including technological capabilities) in developing countries. Multiple OLS or Tobit regressions were run relating export achievements to particular characteristics of firms. Representative studies from this literature can be highlighted as follows.[4]

Wilmore (1992) attempted to test the hypothesis that foreign ownership had a positive effect on exports across Brazillian firms. His model of firm-level export performance contained explanatory variables such as firm size, capital intensity, skill intensity, advertising, R&D and foreign ownership. Wilmore's hypothesis was corroborated as foreign ownership turned out to be highly significant (at the 1% level) and positive in sign. Firm size and advertising were both significant and positive in sign, skill intensity was significant but negative in sign, and both R&D and capital intensity were insignificant.

In a study of the exporting behaviour of Indian engineering and chemicals firms, Lall (1986) looked at a number of technology variables - foreign equity, royalties and licenses, R&D, skills and the age of the firm. Of these, age of the firm, skills and royalties are not significant in either industry while foreign equity is insignificant in engineering and weakly significant in chemicals (only at the 10 per cent level). Meanwhile, licences are highly significant in engineering (at the 1 per cent level) and

[3] Subsequent studies using technology indices include: Wignaraja (1998) on Sri Lanka, Wignaraja and Ikiara (1999) on Kenya, Romijn (1999) on Pakistan and Wignaraja (2002) on Mauritius.

[4] See also Kumar and Siddharthan (1993) on India, Wignaraja and Ikiara (1999) on Kenya and Rasiah (2006).

R&D is significant in both industries but with opposite signs. In general, Lall's results provide evidence of the importance of technological determinants at firm-level.

Bhaduri and Ray (2004) examined five firm-specific determinants of firm-level export performance (technological capability, ownership, firm size, imported raw materials and age of the firm) in pharmaceutical and electrical/electronics firms in India. Technological capability, R&D effort and firm size turn out to be key determinants of export performance in both industries. The foreign ownership dummy is also positive and significant at the 10% level in pharmaceuticals providing weak evidence that foreign firms are more successful in exporting than domestic firms.

Rasiah (2003) sought to examine the importance of foreign ownership and technological capabilities in determining electronics exports from Malaysian and Thai firms controlling for other influences (firm size, age, the average wage and union membership). His hypothesis was that foreign firms are endowed with higher export and technological capabilities than local firms given their superior access to tangible and intangible assets and markets. The positive sign and significance of foreign ownership dummy and R&D expenditure confirmed the hypothesis. The positive sign and significance of the average wage also indicated that skills also influenced exports.

In a small sample study of clothing and engineering firms in Sri Lanka, Wignaraja (1998) related export shares to capital, skills, firm size, ownership and technology. Only the proxy for skills (the average wage) and a proxy for technology (the share of quality control manpower in employment) were statistically significant at the 5% level. He concluded that skills and technology influenced firm-level export performance in Sri Lanka.

Wignaraja (2002) tested export propensities from clothing firms in Mauritius against the share of foreign equity, technological capabilities, the share of engineering manpower in employment, age of the firm and firm size. Foreign equity and technological capabilities have the expected positive sign and are both significant at the 1% level highlighting the influence of these variables in clothing exports at firm-level.

Likewise, cross-section econometric work on the determinants of the technology index has yielded some interesting results. Westphal *et al.* (1990) examine the effect of (firm size, ownership, market orientation and incentives given by the Board of Investment) in determining different technology indices for a sample of Thai electronics, biotechnology and materials technology enterprises. In a regression of a production technology index, he found that the firm size coefficient was significant at the 10 per cent level and positive. Using a sample of Kenyan garment and engineering enterprises, Wignaraja and Ikiara (1999) regressed an overall technology index against firm size, foreign equity, entrepreneur's education level, technical manpower and employee training. They report that firm size, foreign equity and entrepreneur's education were all significant (5 per cent level) and positive.

Finally, in a departure from the studies mentioned above, Romijn (1999) conducted econometric work using technology indices based on the manufacturing complexity of products on a sample of engineering firms in Pakistan. In her best two regressions, firm size turns up as significant (1 per cent level) and positive. Among the other

explanatory variables, external technical assistance and improvements made to products are both significant (1 per cent level and positive while search for information had a positive sign but was significant at the 5 per cent level.

The above studies also indicate that firm-level export performance (and technological capability building) in developing countries is affected by national policy and institutional factors. The list of possible policy and institutional factors is quite long and their interactions are often complex. In general, an outward-oriented development strategy, a conducive investment climate and a rich endowment of business services are among the key factors which encourage firm-level export and technological performance.

3) T-TEST AND ECONOMETRIC RESULTS

3.1 Data and T-test Results

The study uses data from the ADB/World Bank investment climate survey of urban and rural enterprises in Sri Lanka conducted in 2004 (see ADB/World Bank, 2005). The ADB/World Bank survey selected firms on a largely random basis using a stratified simple random sample design. The cross-section data on 205 clothing firms are for the 2003-2004 period. The sample includes 47 foreign-owned and 158 domestic enterprises, which cover a range of market orientation, sizes classes and locations in Sri Lanka.

Table 1 shows the results of T-tests comparing the means of some characteristics of the foreign and domestic clothing firms (including export shares, capacity utilization rates, firm size, age of the firm, replacement cost of capital, imported equipment ratios, CEO education and experience and share of foreign employees).

Table 1: T-tests of Differences of Means of Foreign and Domestic Clothing Firms[/a]

	Foreign	Domestic	t-value*
Share of exports in sales (%)	81.11	40.75	4.88
Capacity utilization rate (%)	85.78	74.51	3.36
Number of permanent employees	1,060	259	6.21
Age of firm (years in production)	13.84	22.13	-2.93
New imported equipment (% of equipment)	47.09	24.45	2.85
Replacement cost of capital ('000 Rupee)	200,906	37,465	6.55
Education level of CEO[/b]	5.15	3.52	4.56
Years of export experience of CEO	16.02	9.12	4.45
Foreign employees (% of employment)	25.92	1.91	5.45

**All differences in means are significant at 1% level.*
/a Conducted on 47 foreign firms and 158 domestic firms.
/b This was measured discretely by a scoring system of seven categories ranging from below secondary schooling (1) to post-graduate degree (7).

The following conclusions may be drawn:

- Foreign firms record better performance than domestic firms. There is a significant difference in exports to sales ratios of the two groups as well as capacity utilization rates. Sales to export markets account for more than 80

percent of total sales of foreign firms while it is only about 40 percent for domestic firms.

- Foreign firms are larger size in terms of the number of workers employed. On average, foreign firms have 1,060 permanent employees while domestic firms have 259 permanent employees.
- Most foreign firms are younger than domestic firms as shown by significant differences in the age of the firm between the two groups by about ten years. Thus the advantages of foreign ownership more than outweigh possible gains from "simple learning by doing" as time passes.
- Foreign firms invest more in modern equipment than domestic firms. The means of the replacement value of capital and the shares of new equipment in total equipment are significantly higher in foreign than in domestic firms. Almost half of imported equipment of foreign firms is new while it is only a quarter for domestic firms.
- Foreign firms have better human capital than domestic firms. This is indicated by significant differences in the means of the educational attainment of the CEO, the years of export experience of the CEO, and shares of foreign employees in employment. For instance, the means for the level of educational attainment of the CEO are 5.02 and 3.53, respectively (where 5 indicates a completed university-level undergraduate degree and 3 only vocational qualifications).[5]

3.2 Factors Affecting Firm-level Export Performance

A firm-level export function was estimated for Sri Lankan clothing firms using a Tobit model. [6] The dependent variable is the export to sales ratio (EXSH). The full linear model as follows:

EXSH = *f* (RVE, WAGE, SKW, CEOED, CEOEXP, FE, SIZE, TI, LOC)

The hypotheses and independent variables are as follows.

Capital is represented by the replacement value of capital per employee (RVE). Within a given activity, a higher level of physical capital in the form of modern equipment is expected to give a firm a competitive advantage. Thus, RVE is expected to be positively associated with export performance.

Human capital is captured by four variables: the share of wage bill to total sales (WAGE), the share of skilled workers in employment (SKW), the level of education of the chief executive officer (CEOED),[7] and the years of experience of the chief executive officer (CEOEXP). Within a given activity, a higher level of human capital is likely to give a firm a competitive export advantage and is expected to have a

[5] The share of skilled production workers and the average wage, however, do not show up as significantly different between the two groups.

[6] Of the 205 clothing firms in the survey, 86 have zero export values. One of the problems in the estimation of the determinants of the export ratio is that there may be selectivity bias if we were to include only firms with positive exports. The Tobit model, however, includes all firms, i.e. also those with zero exports. See Maddala (1983) for a discussion of Tobit models.

[7] This was measured discretely by a scoring system of seven categories ranging from below secondary schooling (1) to post-graduate degree (7). While this variable can be treated as a dummy variable with six values, we treated it as a single variable using it as a scoring system.

positive effect on export performance. In this regard, different levels of human capital - factory floor skills, technical/managerial skills of employees, and the chief executive's educational attainment and experience of exporting activity - are all likely to be important. Owing to data constraints, many studies of firm-level exporting only include factory floor skills. On the other hand, the lower wage share, which reflects the skill-adjusted average wage rate in relation to productivity per worker,[8] the greater is the firm-level competitive advantage that is expected to result in better export performance.

Foreign ownership, the share of foreign equity (FE), is expected to have a positive influence on export performance. Access to the marketing connections and know-how of their parent companies as well as accumulated learning experience of producing for export make foreign affiliates better placed to tap international markets than domestic firms (see Dunning, 1993 for a discussion of the ownership advantages of multinationals). Furthermore, foreign firms tend to be larger than domestic firms and therefore better placed to reap economies of scale in production, R&D and marketing. A large firm will be better able to exploit such scale economies and enjoy greater efficiency in production, enabling it to export more.

Firm size (measured by a dummy variable[9]) is expected to have a positive sign because exporting allows large firms, especially in small economies, to exploit economies of scale in production by relieving the disadvantage of the small home market.

Technological capabilities are measured by a firm-level technology index (TI). We expect TI to be positively associated with export performance because the process of acquiring technological capabilities in enterprises is not just a simple function of years of experience but of more conscious investments in creating skills and information. Such investments would include search, training and engineering activities. The TI used here is a simple production capability based variant of indices developed by Wignaraja (1998) and (2002) for Sri Lanka and Mauritius, respectively. The TI was constructed by ranking a clothing firm's competence across a series of technical functions and the results were normalised to give a value between 0 and 1.[10] Formal research and development (R&D) activities are excluded from the TI but included in the analysis as a determinant of TI (see Section 3.3).

The effect of an *urban location* is captured by a dummy variable (LOC), which takes the value 1 for firms located in and around Colombo and 0 otherwise. Favourably located firms are likely to have lower transport costs to the country's main seaport and benefit from externalities (e.g. ready access to suppliers of raw materials and sub-

[8] W/S = (W/L) / (S/L) where W/S is the share of wages to sales, W/L is the skill-adjusted average wage rate and S/L is the sales per worker.

[9] Some correlation (0.36) between employment and foreign equity (see Table A2) indicates the possibility of multicollinearity meant that firm size was captured by a dummy variable that takes a value of 1 if a firm is large (more than 100 employees) and 0 if a firm is small (equal to or more than 100 employees).

[10] Drawing on the Lall (1992) taxonomy of technological capabilities, the ranking procedure integrates objective and subjective information into measures of a firm's capacity to set up, operate and transfer technology. Five technical functions performed by the Sri Lankan clothing firms were highlighted (including search for technology, inventory control, process adaptation, minor adaptation of products and new product introduction) and a score for each function was awarded based on the assessed level of competence in that function. A firm is ranked out of a total score of 5 and the result is normalised to give a value between 0 and 1. This figure can be interpreted as the overall capability score for a firm.

contractors; marketing and other business services; and government services) compared with more distant firms. Thus, LOC is expected to be positively associated with export performance.

Table 2 shows the estimated Tobit models. Estimated equation (1) presents the general model discussed above and equation (2) the reduced form with only the significant variables. Following testing for multicollinearity and heteroscedasticity, the results of equation (2) are considered.[11] The pseudo R^2 in equation (2) is acceptable for a cross-section model. Of the nine independent variables, six are significant (mostly at the 1% level) and have the expected sign.

Strikingly, FE is significant and positive which indicates that foreign firms are more successful exporters than domestic firms. The explanation lies in a combination of access to marketing connections and know-how of their parent companies, accumulated learning experience of producing for export, and economies of scale linked to firm size. The correct sign and significance of SIZE underlines the links between firm size, ownership and exporting.

Table 2: Estimated Tobit Models (Dependent Variable: EXSH)

Variable	Estimated Equation (1)		Estimated Equation (2)	
RVE	-0.008			
	(-1.00)			
WAGE	-114.159	***	-112.234	***
	(-3.11)		(-3.36)	
SKW	80.790	**	71.787	**
	(2.39)		(2.28)	
CEOED	0.550			
	(0.12)			
CEOEXP	1.163			
	(1.06)			
FE	0.514	*	0.600	**
	(1.93)		(2.46)	
SIZE	134.675	***	137.397	***
	(5.21)		(6.08)	
TI	81.503	*	72.799	*
	(1.79)		(1.76)	
LOC	56.707	***	59.448	***
	(2.88)		(3.23)	
Constant	-124.028	***	-108.158	***
	(-2.91)		(-3.08)	

[11] A correlation test was used to detect for multicollinearity. The correlation matrix of variables in Table A2 shows that no large correlations were noted between any of the independent variables, thus indicating that multicollinearity was not a problem. The Goldfeld-Quandt test revealed an F-statistic of 1.006 with 1% level of significance indicating mild heteroskedasticity in equation (2). To correct for heteroskedasticity for the Tobit model, equation (2) was re-estimated using interval regression, which allows the use of robust option to obtain the Huber-White robust standard errors. The estimated coefficients and their levels of significance using this method turned out to be almost similar as those of Tobit estimates. Hence, the Tobit estimates were retained for analysis.

LR chi^2	122.96 ***	129.50 ***
Pseudo-R^2	0.16	0.15
No. of Observations	169	178
***Significant at 1% level; ** at 5%; * at 10%. Figures in parentheses are t-values.		

TI is significant (at the 10% level) and positive, emphasising that conscious investments in skills and information to use imported technologies efficiently contributes to export performance. More generally, this finding suggests that domestic technological activity and foreign ownership are complements rather than substitutes in developing export capabilities at firm-level.

Two of variables for human capital (SKW and WAGE) are significant and with the correct signs. Within a given activity, a higher level of human capital in the production and a lower wage rate in relation to productivity, give a competitive export advantage. The chief executive's educational attainment (CEOED) and experience (CEOEXP) show no significance.

RVE shows no significance, which may be due to difficulties in measuring the replacement value of capital.

LOC is significant and positive. A location near Colombo provides an export advantage due to lower transport costs to the seaport and the benefits of numerous locational externalities.

3.3 Factors Affecting the Firm-level Technology Index

A firm-level technology function was estimated for the Sri Lankan clothing sample using an OLS model. The dependent variable was the technology index (TI). The full linear model is:

TI = *f* (SIZE, AGE, AGESQRD, PROF, CEOED, TRNG, R&D)

The hypotheses and independent variables are as follows.

Firm size, represented by total employment (SIZE), is expected to have a positive sign. The returns from capability acquisition are higher where a firm has a larger volume of sales to spread the fixed costs of capability acquisition and larger firms can have more specialised manpower and equipment. As foreign firms tend to be larger than local firms, firm size may also capture the influence of foreign ownership and their ownership advantages.

The *a priori* relationship between *age of firm* (AGE) and TI remains ambiguous. Theoretically a positive relationship with TI may be expected because years of accumulated experience can crudely capture "learning by doing" amongst other things. A negative sign is likely, however, if foreign firms using superior imported technology and enjoying access to international markets began operations recently. To test for the presence of a non-linear impact on TI, the square of age of the firm (AGESQRD) was used as well.

Human capital, captured by the share of university-level educated employees (PROF) and the level of education of the chief executive officer (CEOED), is expected to have a positive sign. Better educated chief executives and a larger base of university educated manpower can have a significant influence on technological capabilities through more effective search, engineering and research activities.

Training (measured by expenditure on employee training as a percentage of sales, TRNG), is expected to have a positive sign. Explicit employee training is crucial during enterprise start-up for creating the requisite capabilities to use new production technologies. As technologies evolve, a continuous process of re-training is needed to supply the technical and managerial skills needed by new process and product innovations.

Research and development (represented by R&D expenditure as a percentage of sales) is expected to be positively related to TI. Efforts to acquire production capability in clothing firms can be supplemented by more formal in-house technological effort by technical manpower directed at new product designs, new fabrics (e.g. synthetics or rubber/cotton mixes), process adaptation and trouble shooting.

Table 3: Estimated OLS Regressions (Dependent Variable: Technology Index)

Variable	Estimated Equation (1)	Estimated Equation (2)	Estimated Equation (3)
SIZE	14.736 ***	14.752 ***	15.824 ***
	(3.83)	(4.28)	(4.60)
AGE	-0.400 *	-0.403 *	
	(-1.79)	(-1.83)	
AGESQRD	0.004 ***	0.004 ***	
	(2.69)	(2.70)	
PROF	0.690 ***	0.687 ***	0.666 ***
	(5.96)	(6.58)	(6.70)
CEOED	-0.121		
	(-0.14)		
TRNG	0.712		
	(0.16)		
R&D	8.433 **	8.535 **	9.127 **
	(2.02	(2.09)	(2.13)
Constant	40.493 ***	40.289 ***	34.294 ***
	(8.02)	(9.33)	(12.83)
F-statistic	10.74 ***	15.09 ***	19.89 ***
R^2	0.18	0.17	0.16
No. of Observations	159	159	159

***Significant at 1% level; ** at 5%; * at 10%.
Figures in parentheses are t-values.

Table 3 shows the estimated OLS model results. Equation (1) is the general model and (2) and (3) are the reduced form models. Following testing for multicollinearity

and heteroskedasticity, we consider the results of equation (2).[12] The R^2 in equation (2) is reasonable for a cross-section model. Five of the seven independent variables are significant mostly at 1% level.

Firm size, university educated employees and R&D have a positive and significant relationship with TI. The correct sign on the firm size variable suggests that the different explanations for the firm size effect are valid. It is also likely that firm size may reflect foreign ownership. The positive sign on the university-educated workers variable suggests that higher-level skills are related to building technological capabilities. The positive sign on the R&D variable indicates that formal R&D efforts complement efforts at enhancing production capability.

Age is shown to have a non-linear impact on TI. A plausible explanation for this finding is the fact that foreign owned firms (with superior technology and market access) began operations recently. Furthermore, with learning by doing, local firms gradually acquire technological capabilities. There may also be a minimum age that has to be reached before a domestic enterprise accumulates the requisite level of technological capabilities for export markets.

Meanwhile, the CEO's education level and training expenditure show no significance. Further work is needed to find explanations for these results.

4) INVESTMENT CLIMATE AND BUSINESS SUPPORT SERVICES

The investment climate shapes the exporting and technological behaviour of firms. In a gradual economic reformer like Sri Lanka, enterprise surveys that rank obstacles related to the investment climate can highlight areas for improvement. Previous enterprise studies by Levy (1993) and Lall, Rao and Wignaraja (1996) identified the following constraints in Sri Lanka's investment climate in the early 1990s:[13]

- The main problems were thought to be on the supply-side of exporting. Labour related factors – industrial unrest, labour regulations and low productivity – were viewed as the leading constraints to export growth and upgrading in Sri Lanka.
- Weak technology support institutions and skilled shortages were also emphasised as significant supply-side constraints to exporting.
- Firms pointed to policy uncertainty and an appreciating exchange rate as key constraints on the policy and incentive framework side of exporting in Sri Lanka.
- Excessive holidays were another obstacle in Sri Lanka and some firms mentioned the difficult security situation as contributing to a worsening of the country's image and a deterrent to potential foreign investment.

[12] The variance inflation factors for the independent variables specified in the fitted model were considerably low, suggesting that multicollinearity was not a problem in equation (2). Some Heteroskedasticity was expected to be present in a sample of varied firm sizes and was confirmed using the Breusch-Pagan/Cook-Weisberg test for heteroskedasticity for linear regression models. Accordingly, equation (2) was re-estimated using the robust variance estimator, which corrects for Heteroskedasticity, and the results presented in Table 3.

[13] Other enterprise studies have had a narrower focus. World Bank (1994), for instance, identified the five main constraints to exporting in Sri Lanka in 1993 as roads, access to managers, air transport, environmental regulations and finance. There is little reference in this survey to policy uncertainty and exchange rate issues, or to supply-side factors (e.g. low labour productivity or lack of technological support).

The ADB/World Bank (2005) firm survey indicates constraints to doing business (as well as the quality of business services) a decade later (2003-2004). Table 4 reports the constraints identified by foreign and domestic clothing firms grouped under three headings (policy and incentive framework, supply-side factors and other). Firms perceive that Sri Lanka's investment climate in 2003/2004 poses many constraints inspite of three decades of economic reform. The following were indicated:

- The most serious problem relates to electricity supply and pricing.
- This is closely followed by economic policy uncertainty, macroeconomic instability, transportation, labour regulations and corruption.
- Skills and education of available employees, cost of financing, and crime and disorder were also significant among constraints mentioned by firms.

Table 4: Constraints to Business Operations of Foreign and Domestic Firms
(% of firms reporting factors below as major or severe obstacles)

	Foreign	**Local**
POLICY AND INCENTIVE FRAMEWORK		
Economic policy uncertainty	31.9	35.5
Macroeconomic instability	29.8	31.0
Tax rates	21.3	23.4
Customs and trade regulations	14.9	15.8
Unfair competitive practices	12.8	19.6
Tax administration	12.8	13.4
Environmental regulations	2.1	14.6
Business licensing and operating permits	0.0	7.0
SUPPLY-SIDE FACTORS		
Electricity	38.3	43.0
Transportation	27.7	24.7
Labour regulations	27.7	24.1
Skills and education of available employees	17.0	22.2
Cost of financing	17.0	32.3
Access to financing	8.5	20.3
Telecommunications	8.5	9.5
Access to land	4.3	6.3
OTHER FACTORS		
Corruption	25.5	18.4
Crime and disorder	17.0	15.8
No. of firms	47	158

Source: Computed from ADB/World Bank (2005) using Stata Package 9.0.

There are many similarities in enterprise perceptions by ownership. Foreign firms listed electricity, policy uncertainly, transport and labour regulations as the most notable obstacles. To this list, domestic firms added the cost of financing. Interestingly, access to land, environmental regulations and telecommunications while mentioned as constraints were not accorded much priority. The spread of cheap

mobile telephony has been a driving force in the improvement of this variable over time.

An analysis of business services in Sri Lanka is complementary. Table 5 reports the enterprise perceptions of eight kinds of business support services according to criteria such as availability, affordability and quality of such services. The following are the main findings.

First, with some gaps, a reasonable level of business services are available to foreign and domestic firms in Sri Lanka (as indicted by averages for all business services in excess of 90% for both ownership categories). Accounting and legal services are the most available while technical support from suppliers and marketing are the least.

Second, foreign firms (83.1% on average) typically find business services more affordable than domestic firms (68.9% on average). This may reflect the fact that business services in Sri Lanka are competitively priced by international standards in view of the country's outward-orientation and that foreign firms are more able and willing to pay for such services.

Table 5: Perceptions of Business Services, Foreign and Local firms

	Availability		**Affordability**		**Quality**	
	Foreign	**Local**	**Foreign**	**Local**	**Foreign**	**Local**
1. Engineering	91.3	88.6	87.0	69.0	20.0	19.4
2. Management Consultants	84.8	90.5	76.1	57.6	29.0	12.4
3. Marketing	87.0	84.2	73.9	64.6	11.1	10.8
4. Accounting	100.0	97.5	95.7	84.8	53.9	7.5
5. Legal Services	100.0	93.7	89.4	71.5	9.8	8.3
6. Insurance	95.7	95.6	85.1	73.4	14.0	11.3
7. IT Services	95.7	92.4	78.7	63.3	25.0	15.3
8. Technical Support from Suppliers	78.7	82.9	78.7	67.1	27.3	15.6
Average (of 1 to 8)	91.7	90.7	83.1	68.9	23.8	12.6
No. of firms	47	158	47	158	47	158

Note: Availability and affordability refer to percentage of firms reporting yes to the relevant question; quality refers to percentage of firms reporting somewhat poor or very poor quality.
Source: Computed from ADB/World Bank (2005) using Stata Package 9.0.

Third, a higher percentage of foreign firms complained about the poor quality of business services in Sri Lanka (23.8% of foreign firms on average compared to only 12.6 of domestic firms). This may reflect the fact that foreign firms, with greater experience of international business service markets and standards, are more demanding in their service requirements than domestic firms and that business services in Sri Lanka are of variable levels of quality. Foreign firms complained the most about the poor quality of services relating to accounting, management consultants, IT, technical support from suppliers and engineering. To the extent that they were dissatisfied, domestic firms were concerned about the quality of engineering, IT and technical support from suppliers.

There are thus positive and negative aspects to the investment climate in Sri Lanka. Investment climate perceptions tend to be a barometer for future investment plans and industrial competitiveness performance. International experience suggests that unresolved weakness in a country's investment climate can be a disincentive for enterprises to continue with export-oriented production and invest in technological capabilities. It is possible that a weak investment climate induces foreign firms to begin searching for alternative production locations and for domestic firms to consider shifting into alternative manufacturing and service activities. Hence, the evidence on the investment climate seems to suggest a gradual loss of competitiveness in clothing, the country's leading manufactured export.

5) CONCLUSIONS

This paper highlights that a range of factors should be taken into account to explain why some firms are more export-oriented than others in a small open developing country like Sri Lanka. Most strikingly foreign ownership is positively associated with firm-level export shares in the clothing industry. Hence, the relatively superior exporting behaviour of foreign owned firms (due to access to the ownership advantages of their parent firms, accumulated production experience and large firm size) is supported by econometric evidence.

The positive signs on the technology index and the human capital variables indicate that building domestic technological capability and investments in human capital also influence export shares. Thus, the results from our large sample econometric study confirm those of previous case studies and small sample econometric analysis.[14] In addition, our study highlights the influence of geography on export behaviour, which has not been explored in previous studies on Sri Lanka. A firm located close to Colombo has an export advantage stemming from lower transport costs to the seaport and locational externalities.

The paper also highlights that firm size, university educated employees affect the technological behaviour of Sri Lankan clothing firms. The correct sign on the firm size variable suggests that different explanations for the firm size effect are valid. It is also likely that firm size may reflect foreign ownership. The positive sign on the university-educated workers variable suggests that higher-level skills are related to building technological capabilities. The positive sign on the R&D variable indicates that formal R&D efforts complement efforts at enhancing production capability.

The mapping of enterprise perceptions points to a weakening investment climate in Sri Lanka since the early 1990s. This worrying trend could indicate future investment plans and a gradual loss in the competitiveness of Sri Lanka's leading manufactured export. The most significant constraint is electricity supply and pricing. Other major constraints include: economic policy uncertainty, macroeconomic instability, transportation, labour regulations and corruption. Furthermore, whilst Sri Lanka has a reasonable range of business support services, issues of affordability and service quality remain concerns for clothing enterprises.

[14] See Lall and Wignaraja, (1995); Wignaraja (1998); Deraniyagala (2001); Chandrasiri (2003); and Knutsen (2004).

More generally, the study of Sri Lankan clothing enterprises shows that firm-level investigations of export performance are a fruitful undertaking as they highlight technology, skills and other phenomena that drive the creation of competitive export advantage in developing countries (Lall, 1986 and 1992). When combined with information on the nature of a country's investment climate and business services, such studies can be a powerful tool for the development of policies for private sector development in outward-oriented developing economies. Continuously improving a country's investment climate, facilitating the development of business service markets and upgrading SMEs as subcontractors to foreign firms are the key policy lessons for developing countries.

Table A1: FDI, Exports and Employment in the Clothing Industry in Sri Lanka, 1987-2004 (a)	
1. Annual FDI Inflows in Clothing ($Mn)	
1987-89	11.9
1990-99	169.0
2000-04	264.0
2. Annual Clothing Exports from Foreign Firms ($Mn)	
1987-89	222.5
1990-89	1,189.3
2000-2002	2,028.7
3. Employment in Foreign-owned Clothing Firms (numbers)	
1987	50,743
1997	161,321
2002	280,234
a) Data refer to BOI Projects. Source: Estimated from Central Bank of Sri Lanka (various years).	

Table A2: Correlation Matrix for Clothing Enterprises

	EXSH	RVE	SKW	CEOED	CEOEXP	WAGE	FE	SIZE	TI	LOC
EXSH	1.0000									
RVE	-0.0366	1.0000								
SKW	0.2018	-0.0531	1.0000							
CEOED	0.3753	0.1324	0.0431	1.0000						
CEOEXP	0.2520	0.0938	0.0022	0.1700	1.0000					
WAGE	-0.2718	-0.1334	0.0179	-0.2672	-0.0716	1.0000				
FE	0.3382	-0.0144	0.0515	0.2845	0.3315	-0.1040	1.0000			
SIZE	0.6720	-0.0963	0.1453	0.4695	0.2476	-0.1518	0.3643	1.0000		
TI	0.2748	0.0806	-0.1489	0.2081	0.1016	-0.1070	0.0776	0.3374	1.0000	
LOC	0.2891	-0.0175	0.0402	0.0618	-0.0367	-0.0841	-0.1517	0.2336	0.1416	1.0000
Source: Computed from ADB/World Bank (2005)										

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